

## AEROLOGICAL OBSERVATIONS FOR THE YEAR 1928

By L. T. SAMUELS

The most striking feature of Table 1 is the preponderance of negative departures for all elements, viz, temperature, relative humidity, and vapor pressure. As is usually the case with yearly departures, they are of relatively small magnitude.

Free-air resultant wind directions were northerly instead of southerly at Due West and Groesbeck in February, at Due West and Royal Center in March, at Ellendale in May and September, at Groesbeck in September, and at Due West in December.

A marked lack of southerly component occurred at most stations in April and at Broken Arrow and Royal Center in September, an excess of northerly component at Washington in May, and a southerly instead of the normal northerly component at Due West in October.

The resultant velocities at practically all stations were considerably above normal in January; also at Washington and Ellendale in April, at Due West, Groesbeck, and Washington in June, at Ellendale in September, and at Groesbeck in October.

A total of 1,505 kite flights were made during the year at the five aerological stations and the average altitude was 2,693 meters above sea level. The highest flight of the year (6,000 meters) was made at Royal Center, Ind., on April 18.

One hundred and seventy-one airplane observations were made at the naval air station, Anacostia, D. C.

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during the year of 1928

Altitude m. s. l. (meters)	TEMPERATURE (°C.)									
	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal
Surface..	15.1	-0.4	15.4	-1.4	6.1	+0.5	16.9	-1.2	10.2	-0.8
250.....	15.0	-0.4	15.2	-1.3	6.5	+0.5	16.5	-1.0	10.0	-0.8
500.....	13.9	-0.2	13.9	-0.9	5.9	+0.4	15.5	-0.8	8.4	-0.6
750.....	12.9	-0.2	13.0	-0.6	5.4	+0.4	14.6	-0.8	7.2	-0.6
1,000.....	12.1	-0.2	11.9	-0.6	4.7	+0.1	14.0	-0.7	6.1	-0.7
1,250.....	11.3	-0.1	10.7	-0.6	3.8	-0.2	13.4	-0.5	5.1	-0.7
1,500.....	10.4	-0.1	9.5	-0.6	2.8	-0.4	12.6	-0.4	4.0	-0.8
2,000.....	8.3	0.0	7.2	-0.5	0.4	-0.6	10.3	-0.6	1.8	-0.9
2,500.....	5.8	+0.1	4.8	-0.5	-2.3	-0.7	7.7	-0.8	-0.5	-0.9
3,000.....	3.0	+0.1	2.3	-0.5	-5.1	-0.7	4.9	-1.0	-2.7	-0.6
3,500.....	0.4	+0.3	-0.2	-0.3	-7.9	-0.7	1.9	-1.3	-5.3	-0.6
4,000.....	-2.3	+0.5	-2.9	-0.2	-10.5	-0.5	-1.0	-1.4	-7.9	-0.6
4,500.....	-5.3	+0.3	-6.1	-0.6	-13.1	-0.2	-3.8	-1.5	-10.7	-0.6
5,000.....	-7.7	+0.7	-8.5	-0.3	-17.3	-1.6	-5.2	-0.1	-13.5	-0.2

TABLE 1.—Free-air temperature, relative humidities, and vapor pressures during the year of 1928—Continued

Altitude m. s. l. (meters)	RELATIVE HUMIDITY (%)									
	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal
Surface..	68	0	70	+4	67	-5	75	+1	71	+1
250.....	68	0	70	+4	67	-5	74	+1	70	0
500.....	65	0	67	+2	66	-5	71	0	68	-1
750.....	63	0	64	0	61	-6	66	-2	67	-1
1,000.....	61	0	63	-1	58	-6	59	-4	65	-1
1,250.....	58	-1	62	-2	56	-5	53	-6	62	-2
1,500.....	56	-1	61	-2	54	-5	49	-6	60	-2
2,000.....	52	-1	58	-2	50	-7	44	-5	54	-4
2,500.....	49	-1	56	-1	49	-7	39	-6	50	-4
3,000.....	47	-2	51	-3	48	-7	36	-6	45	-7
3,500.....	44	-4	47	-5	46	-8	36	-4	43	-7
4,000.....	41	-5	47	-4	41	-12	34	-5	44	-4
4,500.....	35	-9	47	-4	39	-13	31	-6	45	-3
5,000.....	24	-19	29	-17	51	+1	27	-10	43	-4

VAPOR PRESSURE (mb.)

Altitude m. s. l. (meters)	Broken Arrow, Okla. (233 meters)	Due West, S. C. (217 meters)	Ellendale, N. Dak. (444 meters)	Groesbeck, Tex. (141 meters)	Royal Center, Ind. (225 meters)	Washington, D. C. (7 meters)*
Surface..	13.61	-0.15	14.04	+0.04	7.67	-0.40
250.....	13.48	-0.17	13.81	+0.02	15.58	-0.58
500.....	12.04	-0.12	12.35	-0.02	7.43	-0.43
750.....	10.82	-0.13	11.18	-0.15	6.51	-0.50
1,000.....	9.75	-0.22	10.20	-0.25	5.87	-0.51
1,250.....	8.75	-0.25	9.21	-0.35	5.33	-0.49
1,500.....	7.88	-0.17	8.27	-0.37	4.79	-0.48
2,000.....	6.20	-0.14	6.61	-0.27	3.75	-0.56
2,500.....	4.88	-0.08	5.30	-0.13	3.00	-0.53
3,000.....	3.89	-0.04	4.18	-0.13	2.39	-0.45
3,500.....	2.99	-0.16	3.37	-0.10	1.84	-0.44
4,000.....	2.35	-0.10	2.84	+0.02	1.33	-0.50
4,500.....	1.61	-0.30	2.23	-0.14	1.03	-0.45
5,000.....	1.03	-0.50	1.41	-0.39	0.90	-0.28

\* Naval air station.

## THE WEATHER IN THE UNITED STATES

## THE WEATHER ELEMENTS

By P. C. DAY

## GENERAL CONDITIONS

December, 1928, was notable for the wide extent of the precipitation shortage, the few days with extensive precipitation either rain or snow, and the preponderance of days having weather favorable for outdoor occupations.

## PRESSURE AND WINDS

The month opened with cloudy weather and local rains over the Atlantic and Gulf coasts and similar

conditions prevailed in the far Northwest, with a low-pressure area developing over the upper Missouri Valley. This low-pressure area advanced southeastward to the Dakotas by the morning of the 2d, attended by light snow over the northern plains and the near-by Canadian Provinces, and extended during the following 24 hours to the vicinity of Lake Michigan with increased intensity, the precipitation area being still confined to the immediate vicinity of the storm center. The storm diminished rapidly after crossing the Lakes and apparently dissipated during the following day in the region to northward of Lake Superior though light snow extended eastward to New York and New England. By the following day,

however, the precipitation area in the northeast had extended southward and in connection with a storm area moving eastward from the southern plains, light rain or snow had overspread an extensive area from the middle Mississippi Valley and Great Lakes eastward except along the south Atlantic coast.

Save for scattered light precipitation in the far West during the first decade, no important cyclonic disturbances crossed the country during that period save as previously indicated.

Beginning early in the first decade, high atmospheric pressure developed over the Plateau region and mostly clear weather prevailed over that region and later to the eastward, until about the 12th, at which time a cyclone of moderate proportions overspread the southern Plateau and Rocky Mountains and moved to eastern Oklahoma and western Arkansas by the morning of the 13th, attended by local heavy rains in portions of the west Gulf States. During the 14th the rain area extended northward to the Lake Michigan area and eastward nearly to the middle and south Atlantic coasts, but was largely dissipated by the morning of the 15th, though some local heavy rains occurred within the 24-hour period near the middle Atlantic coast. Closely following the track of the storm referred to above, another low-pressure area had moved to the southern plains by the morning of the 16th, attended by local precipitation near its path, and by the morning of the 17th it was central over Indiana. Precipitation had covered an extensive area from the southern plains northeastward to beyond Lake Superior, light snow occurring over wide areas from the Missouri Valley northeastward to the upper Lakes, with local heavy rains in portions of the lower Ohio and middle Mississippi Valleys. By the following day the storm center had advanced to the lower St. Lawrence Valley and precipitation had extended to all sections from the Mississippi River eastward save extreme southern Florida, but the falls were mostly light.

Prior to the passage of the cyclone referred to above, high-pressure had again become established in the Plateau region and dominated the weather over that and near-by areas, extending later into most eastern districts during the remainder of the month, some local precipitation occurring during the period along the Pacific coast, but fair weather prevailed in most central and eastern districts.

The average sea-level pressure of the month was above normal in all districts save in Minnesota and small portions of near-by States, the excesses being comparatively large in practically all western regions, but the values diminishing in all directions from the Plateau. Compared with the preceding November pressure was higher in all districts save from the Dakotas and eastern Montana southeastward to the middle and east Gulf coasts.

Due to the general high pressure existing there were few important cyclones, and winds of importance were infrequent though small tornadoes occurred at several points in Texas on the 12th.

The general pressure distribution and prevailing winds are shown on the usual charts, and the main facts as to storm damage appear as usual in the table at the end of this section.

#### TEMPERATURE

The first half of the month showed no marked abnormalities in the temperature distribution, though the week ending the 18th was mainly much warmer than normal over the districts east of the Rocky Mountains and moderately cool to the westward.

The week ending the 25th continued warm over the eastern slope of the Rocky Mountains and from the middle Plains northward and into the western Canadian Provinces, but moderately cool over most other districts except distinctly cold over the Plateau region.

The final week of the year was warmer in all districts save over southern Florida, and the week as a whole was distinctly warm over most northern districts.

For the month as a whole the temperature averages were above normal over all parts of the United States, and Canada as well, from the Rocky Mountains eastward save near the Gulf and south Atlantic coasts where they were normal or slightly below. The averages were decidedly above normal from the upper Missouri Valley eastward and over the adjacent Canadian Provinces, some portions of the northern Plains and upper Mississippi Valley States having averages among the highest of record for December.

The monthly means were below normal in all districts from the Rocky Mountains westward, but the departures were mainly small.

The warmest periods were the 3d to 4th over the Southeastern States, the 7th to 14th in the upper Mississippi Valley, Lake region, and portions of near-by areas, and 27th to 28th in the Ohio Valley and thence to the Rocky Mountains and over the districts to westward.

The minimum temperatures were fairly well scattered through the month, ranging from the 3d to 23d. The lowest reported was 41° below zero at a point in Montana.

#### PRECIPITATION

The precipitation as a whole was unusually light, only six States, all located in the southern Plains and middle Mississippi Valley, having monthly amounts for the State in excess of the normal.

The deficiencies were rather large in the Atlantic coast and east Gulf States, where in several instances the monthly totals were the least of record for 50 years or more, Burlington, Vt., reporting the month as the driest December in the past 100 years.

In areas where the precipitation was above the normal the excesses were mainly small, so that the total precipitation for the month as a whole, considering all parts of the country, was probably the least of record for December.

#### SNOWFALL

December was markedly deficient in snowfall over the greater part of the country. East of the Rocky Mountains the ground was bare or had only a light covering during any material part of the month, and at the end only slight depths had accumulated on the ground in the more northern districts.

In the mountain regions of the West fairly good depths had accumulated by the end of the month in portions of the Rocky Mountain region, and in some of the mountains of the Northwest, but in the high elevations of California and the Southwest the amounts of stored snow were mainly much less than normal.

#### RELATIVE HUMIDITY

Owing to the general absence of precipitation and to the prevalence of mainly higher than the normal temperatures, relative humidity was largely less than normal in practically all parts of the country, though this was not the case in some portions of the Rocky Mountain and Plateau regions, where important excesses in the percentages were noted.